US005426485A

United States Patent [19]

Fujita et al.

[11] **Patent Number: 5,426,485**

[45] **Date of Patent: Jun. 20, 1995**

[54] **CLEANING DEVICE FOR A TRANSFER BELT OF AN IMAGE FORMING APPARATUS**

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[21] Appl. No.: **147,202**

[22] Filed: **Nov. 3, 1993**

[30] **Foreign Application Priority Data**

Nov. 16, 1992 [JP] Japan 4-305560

[51] **Int. Cl.**[6] **G03G 15/14**

[52] **U.S. Cl.** **355/208;** 198/499; 355/271; 355/299

[58] **Field of Search** 355/275, 299, 212, 215, 355/30, 208, 271, 274; 198/497, 499; 474/92

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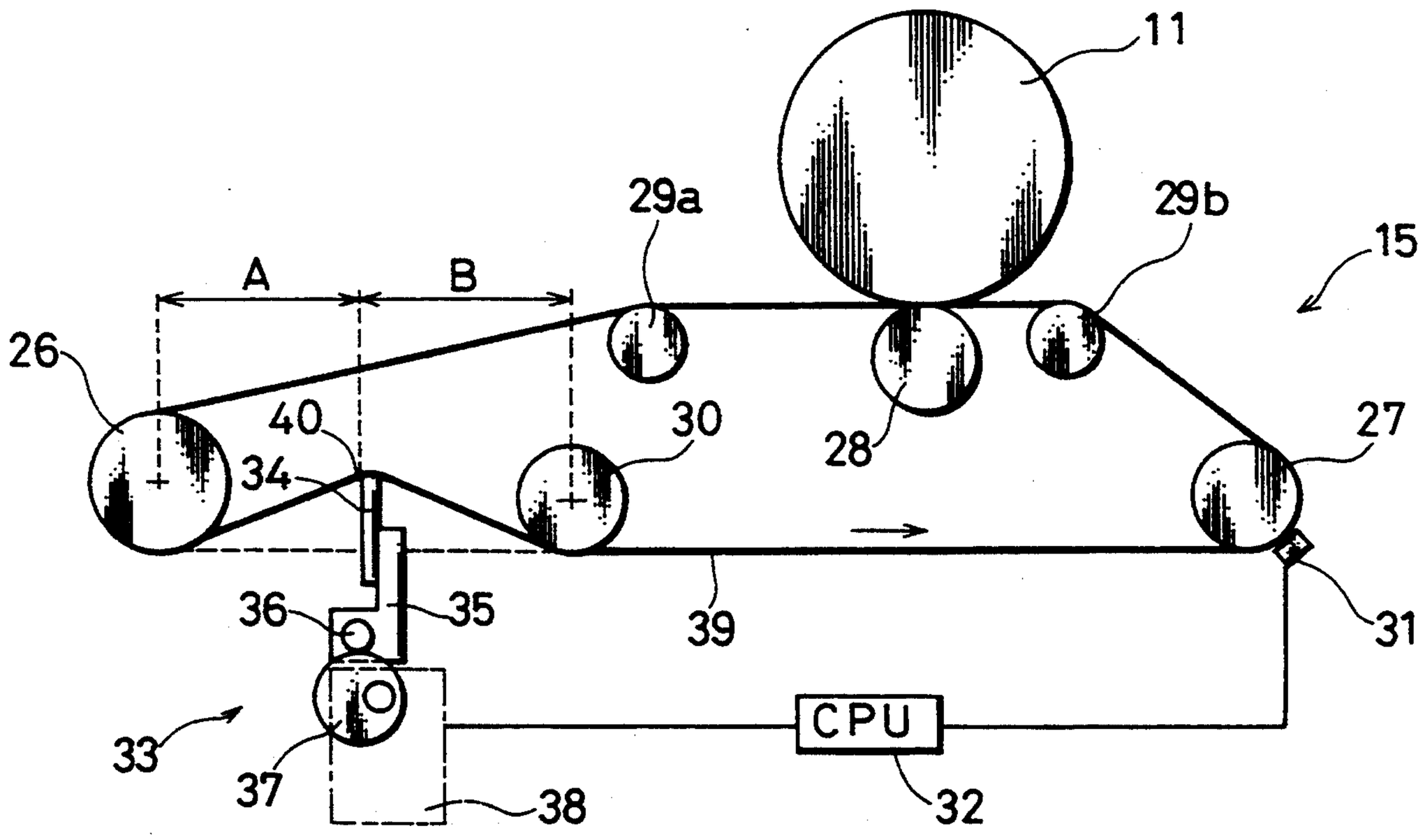
[57] **ABSTRACT**

A cleaning device for cleaning an endless transfer belt which is made of elastic material and stretched between a first roller and a second roller, one of the two rollers being adapted for driving the belt, the transfer belt being able to come into contact with a copy sheet on one stretch side of the transfer belt to convey the copy sheet in a direction from the first roller to the second roller. The cleaning device is provided with a cleaning blade member for removing toner from the belt. The cleaning blade member is disposed on the other stretch side of the transfer belt and near the second roller, being pressed perpendicularly against an outside surface of the belt, and having a leading end portion which is flexed and capable of coming into a line contact with the belt over an entire width of the belt when the belt is driven. The amount of pressing force of the blade against the belt will be adjusted depending on the sensed temperature of the belt.

9 Claims, 8 Drawing Sheets



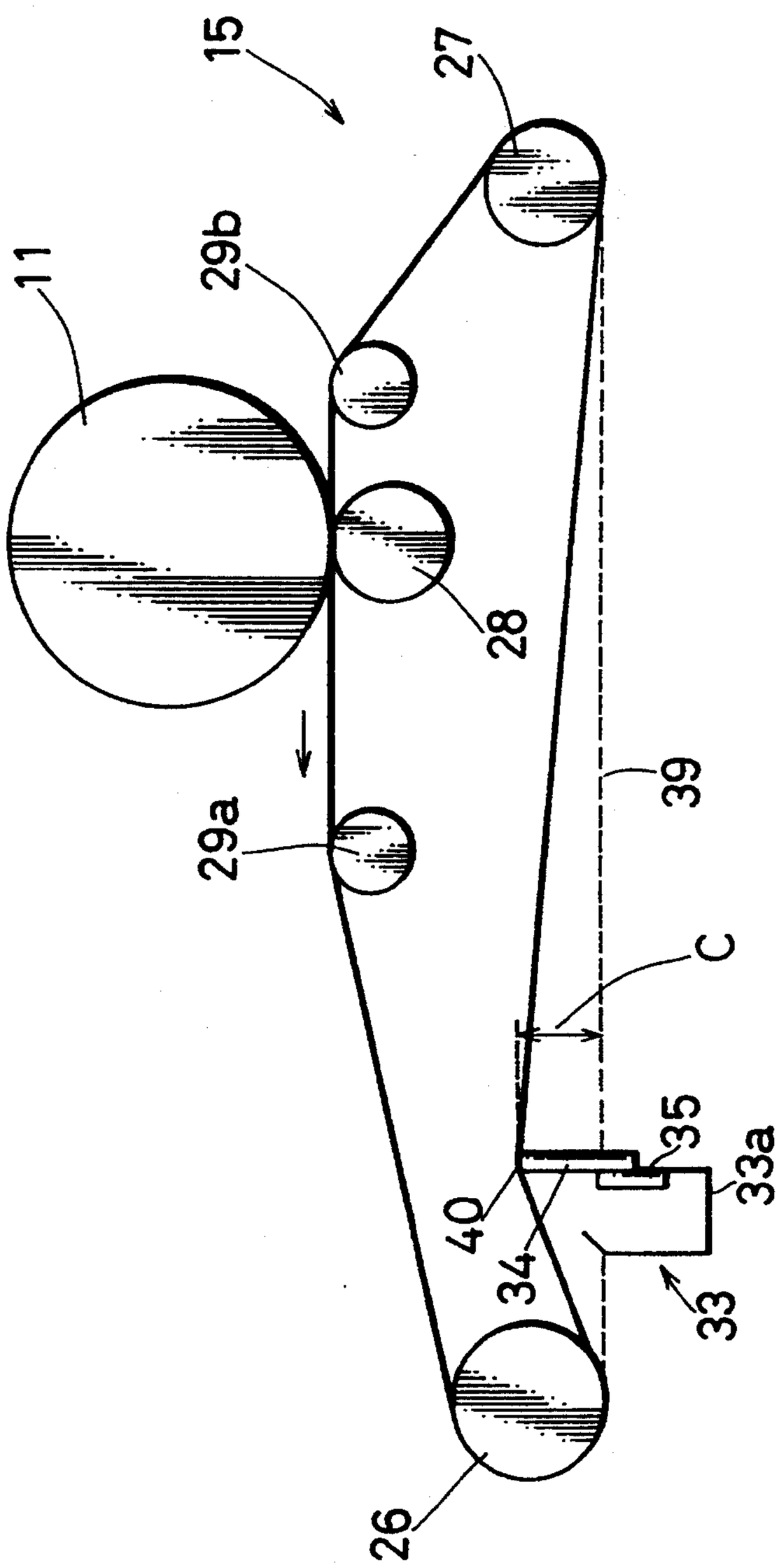


FIG. 1

FIG. 2

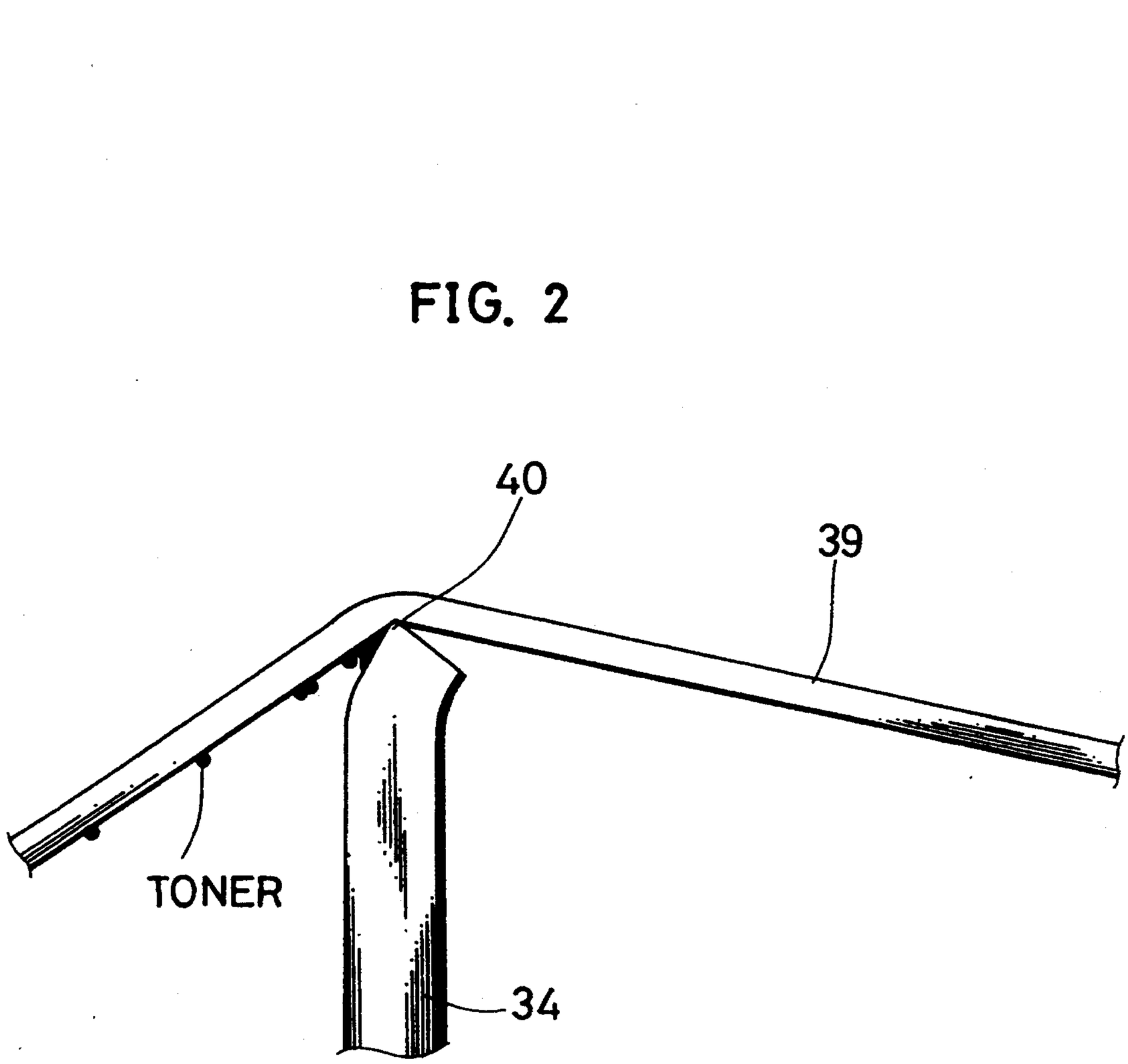


FIG. 3

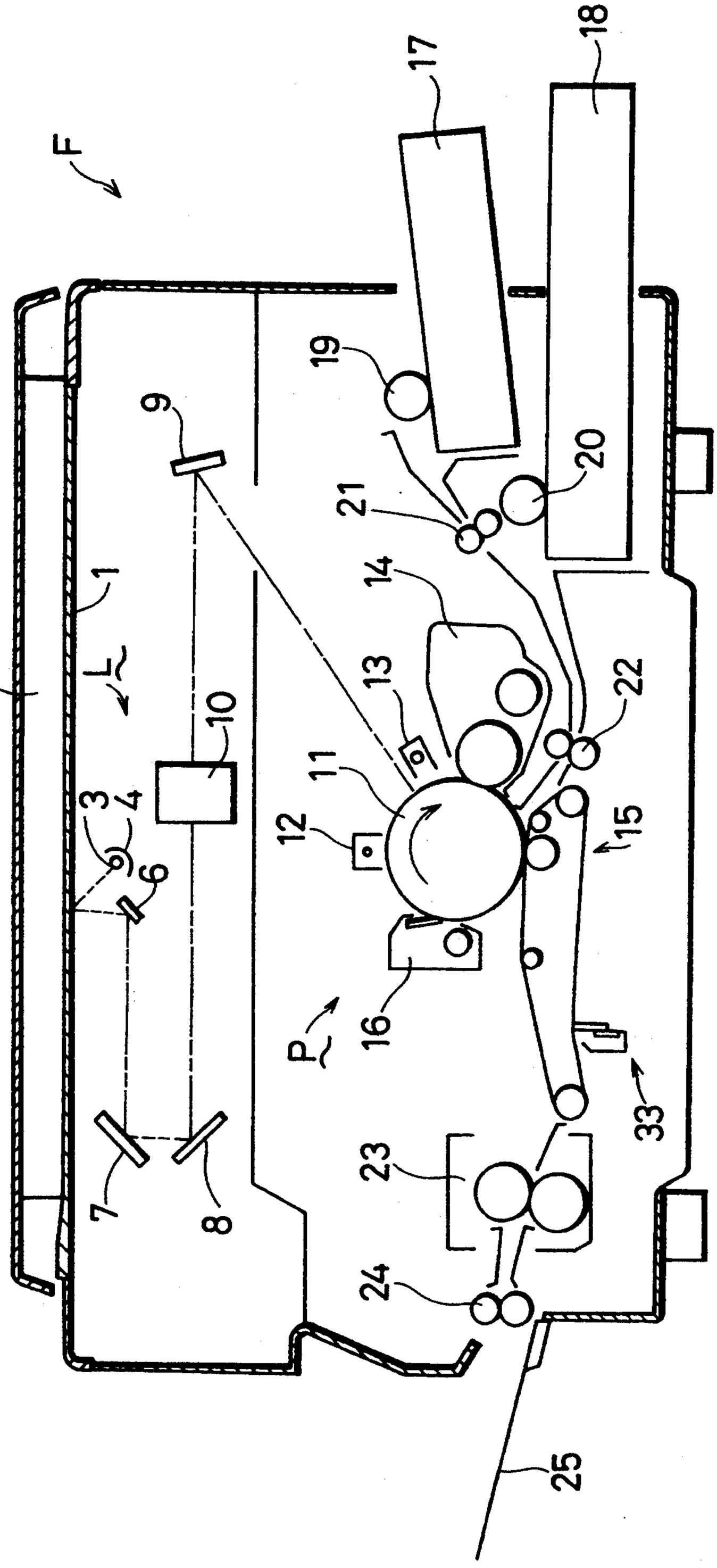


FIG. 4

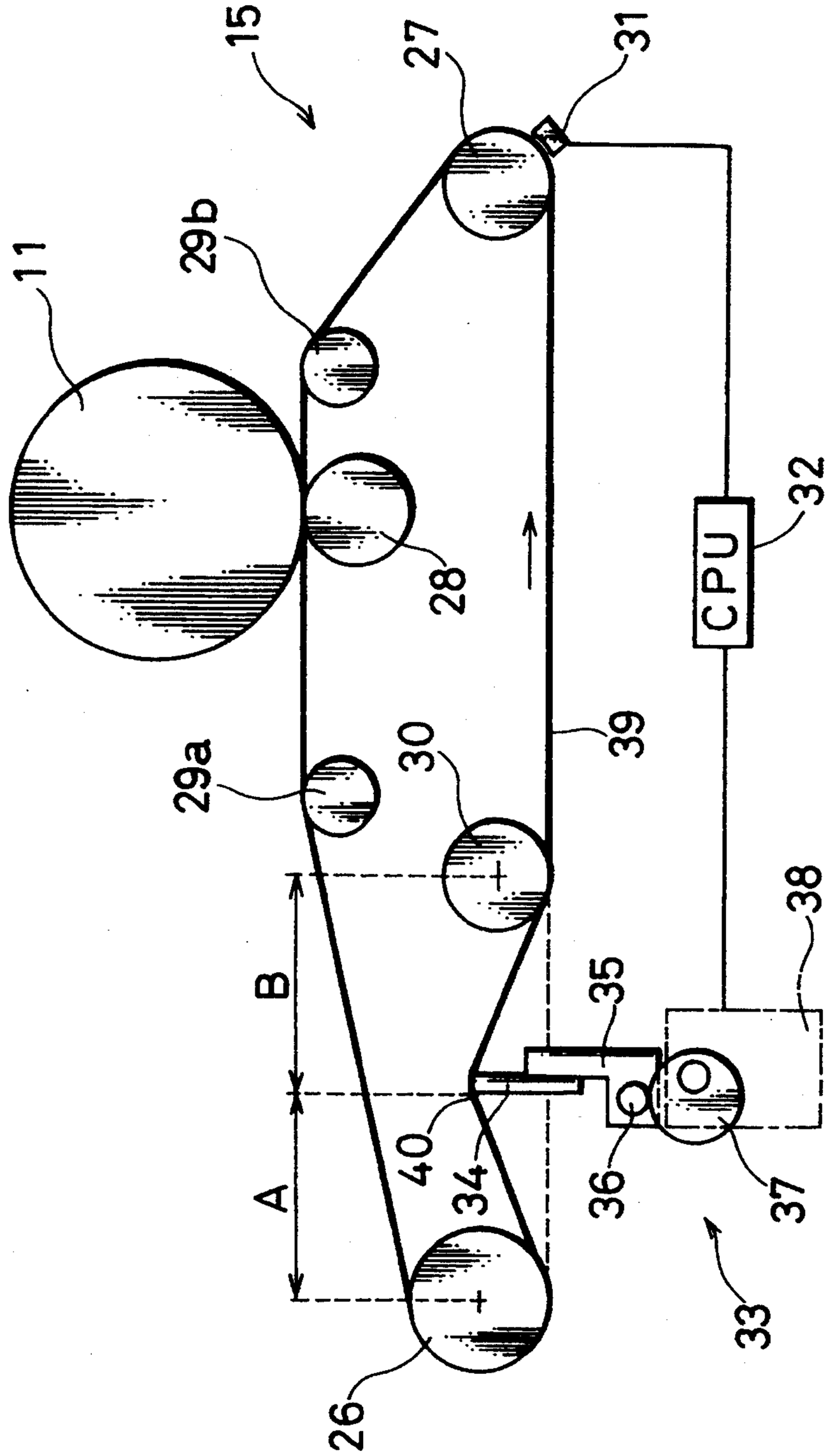
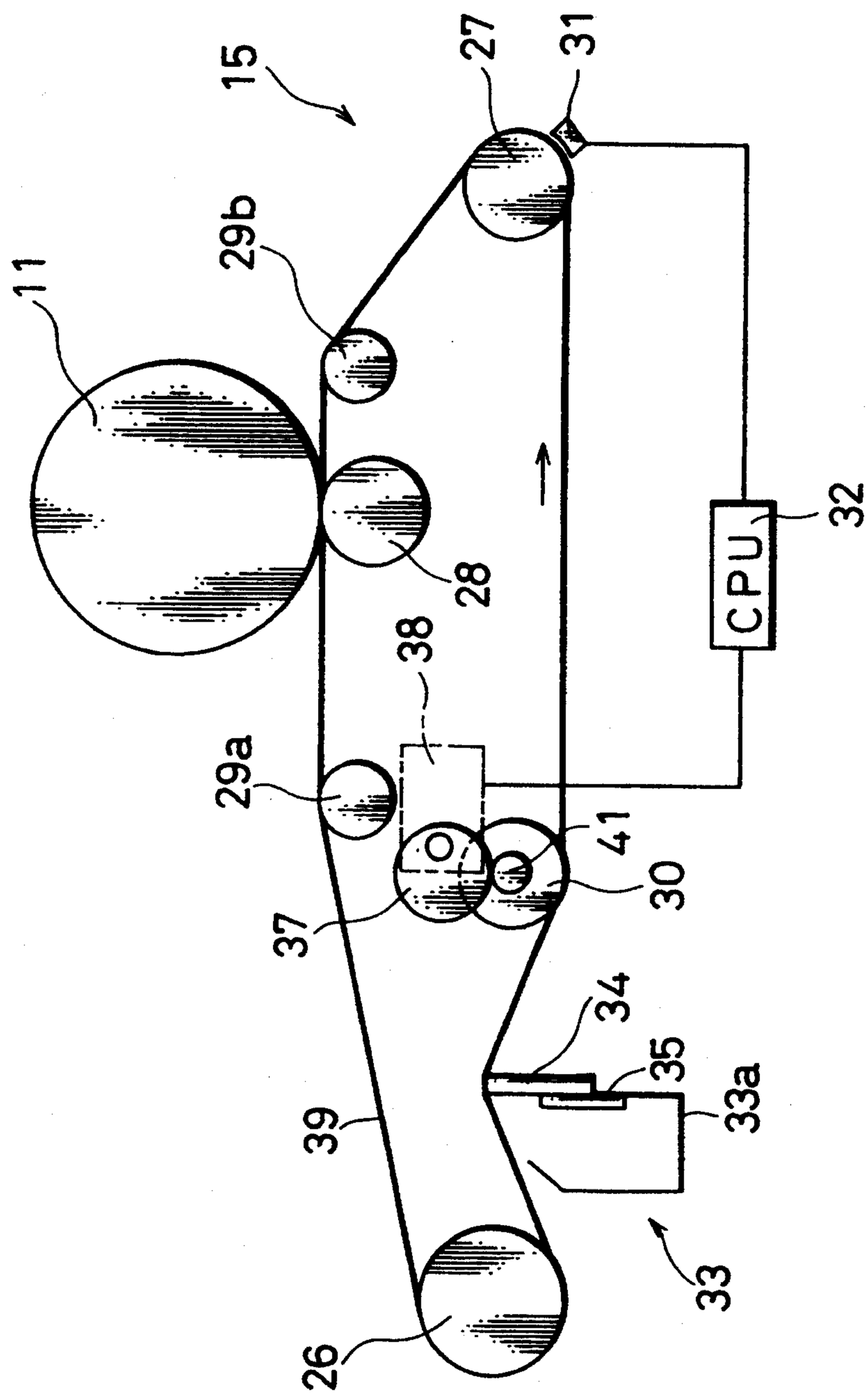


FIG. 5



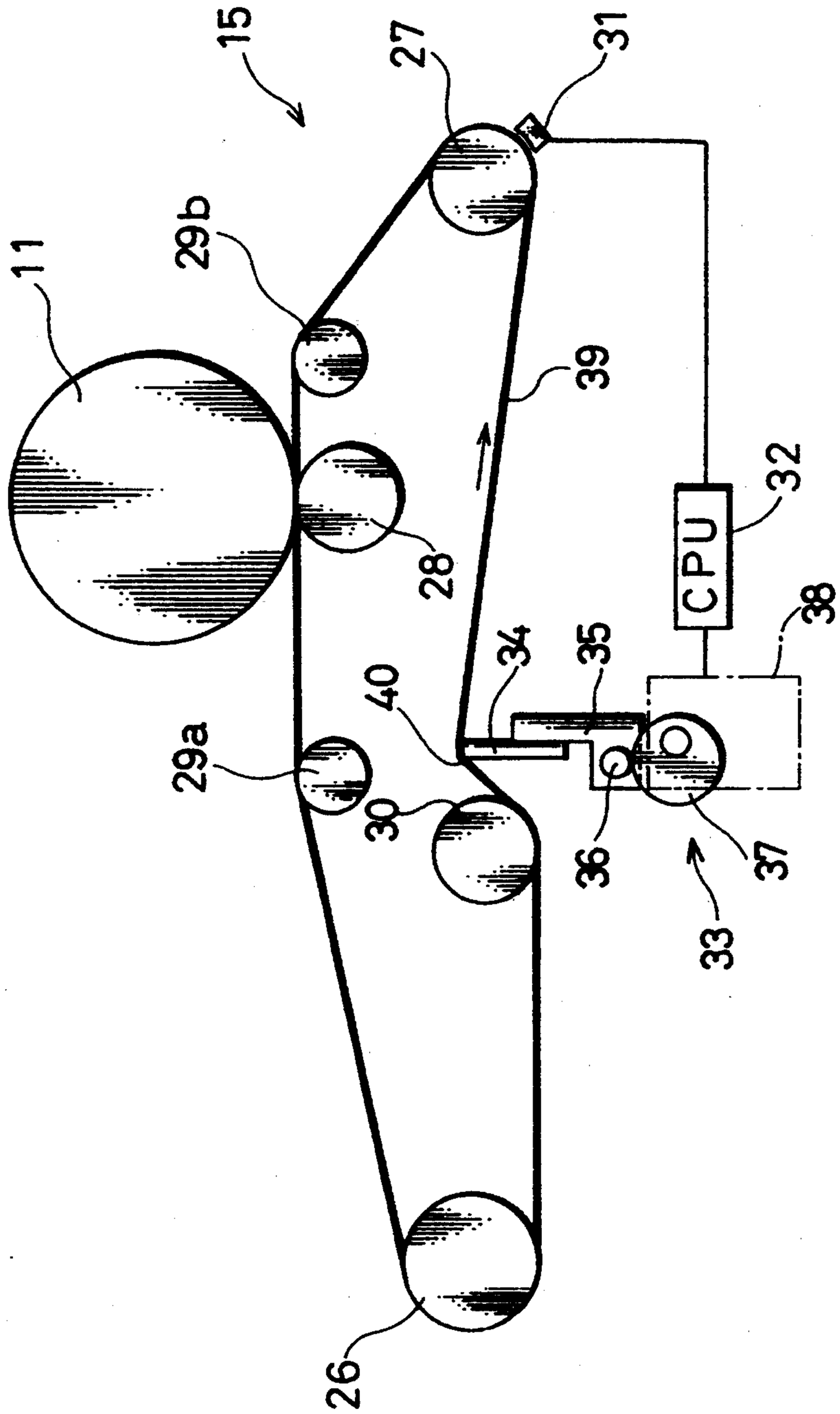


FIG. 6

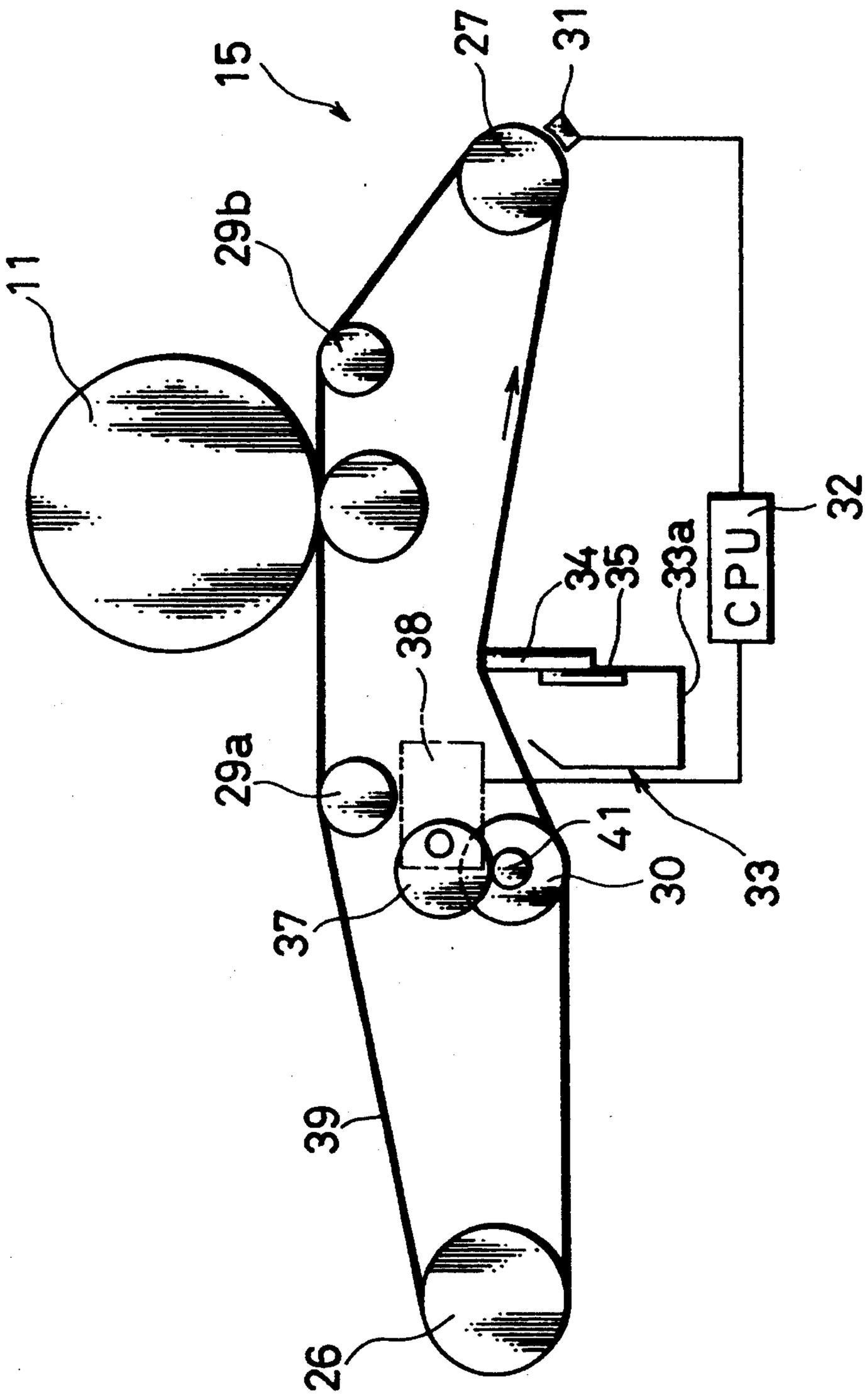
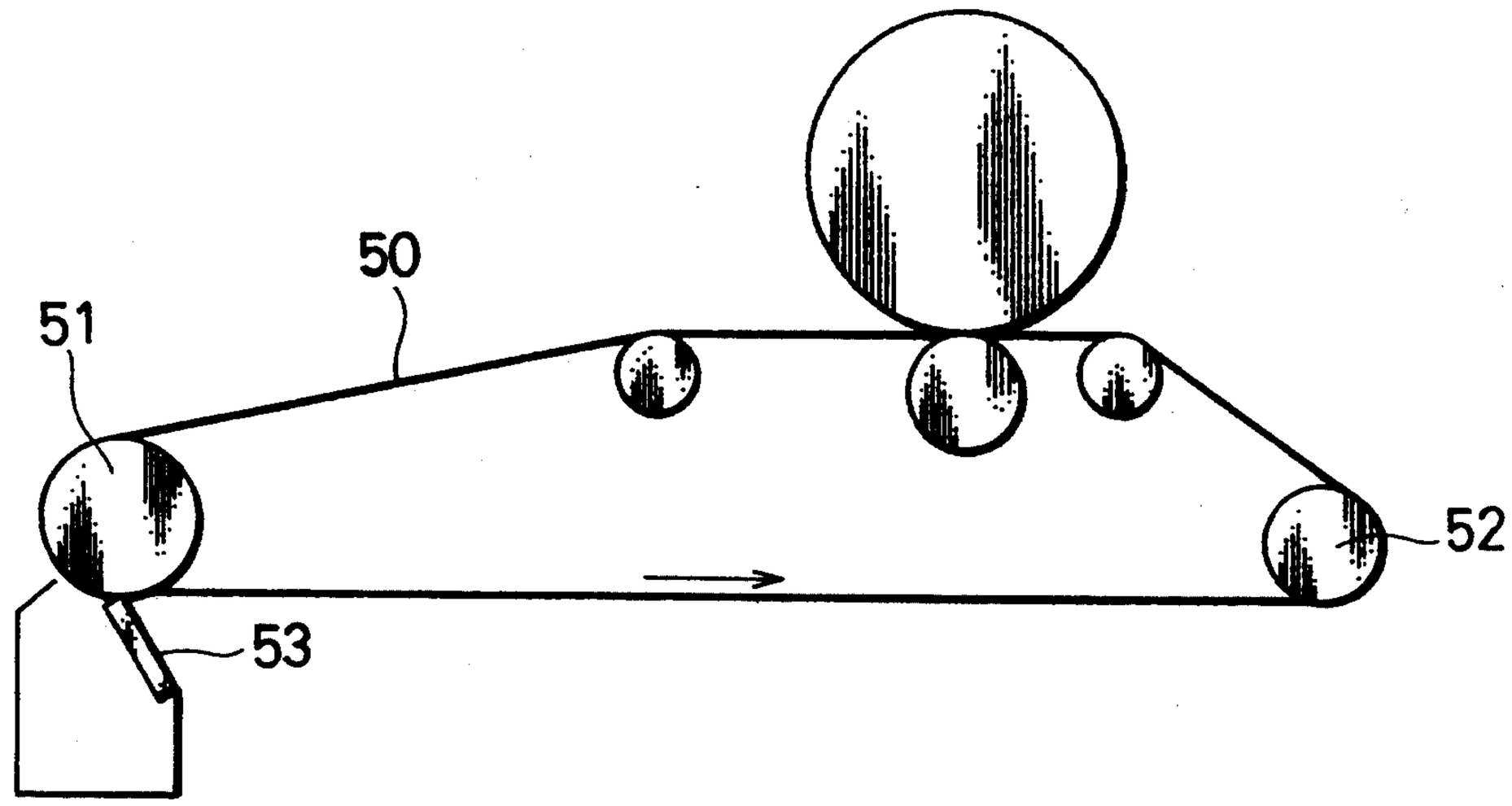
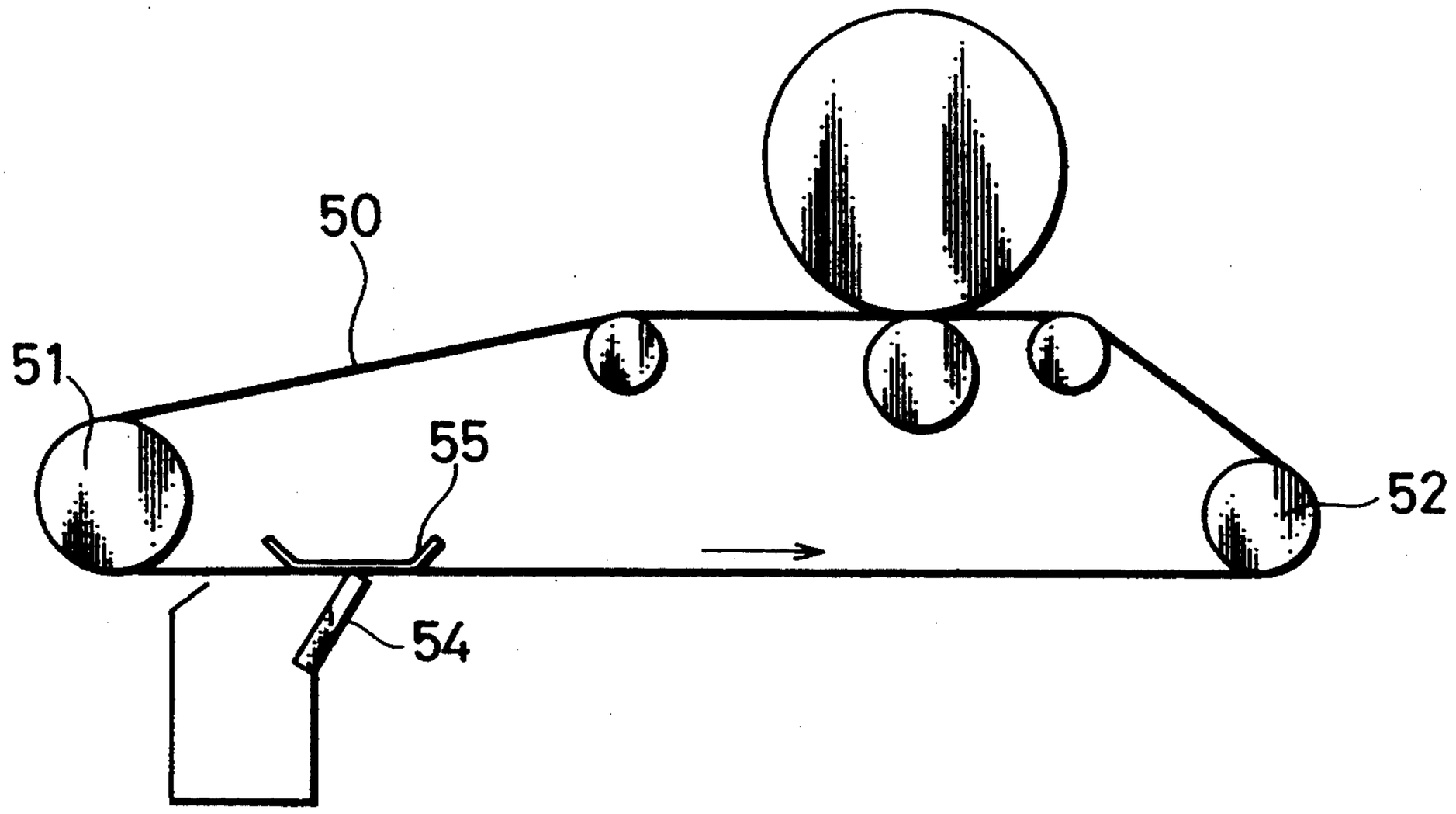


FIG. 7

PRIOR ART
FIG. 8



PRIOR ART
FIG. 9



CLEANING DEVICE FOR A TRANSFER BELT OF AN IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a cleaning device for a transfer belt which is constructed so as to transfer a toner image formed on the surface of a photosensitive member to a copy sheet while transporting the copy sheet in an image forming apparatus such as a copying machine and a printer.

There have been known conventionally image forming apparatuses such as copying machines and printers having a so-called transfer belt made of elastic material. This transfer belt transports a copy sheet fed through a pair of registration rollers from a cassette to a photosensitive drum. The transfer belt, to which a voltage of a specified level is applied, causes a toner image developed by a developing device and formed on the surface of the photosensitive drum to be transferred to the copy sheet, and then transports the copy sheet to a fixing device.

In the above apparatus, toner attached electrostatically to the surface of the photosensitive drum and that from the developing device may fly away and attach to the surface of the transfer belt. This causes the photosensitive drum and the rear face of the copy sheet to be stained. In view of this problem, the apparatus is provided with a cleaning device including a cleaning blade which is brought into pressing contact with the surface of the transfer belt to scratch off the attached toner. As a cleaning device employing a cleaning blade as mentioned above, there are in general two types: a counter type and a trail type. In the counter type cleaning device, as shown in FIG. **8**, a cleaning blade **53** is disposed tiltingly such that a leading end thereof is in pressing contact with the surface of a transfer belt **50** at the bottom of the circumferential surface of a drive roller **51** for rotating the transfer belt **50** and is located backward relative to a base end thereof with respect to a rotating direction of the transfer belt **50** (a direction of arrow in FIG. **8**).

In a trail type cleaning device, as shown in FIG. **9**, a cleaning blade **54** is disposed tiltingly such that a leading end thereof is in pressing contact with the surface of a transfer belt **50** at a position of a placing member **55** disposed between the drive roller **51** and a driven roller **52** where the transfer belt **50** is stretched and is located forward relative to a base end thereof with respect to the rotating direction of the transfer belt **50** (a direction of arrow in FIG. **9**).

In the above cleaning devices, the leading ends of the cleaning blades **53**, **54** are fabricated to have an edge of a desired angle, e.g., right angle, with high accuracy. Thus, a mounting angle is important in bringing the cleaning blades in pressing contact with the transfer belt **50**. In other words, an optimal cleaning function cannot be obtained in the case where the cleaning blades **53**, **54** are not mounted at an appropriate angle with respect to the transfer belt **50**. Accordingly, when the cleaning blades **53**, **54** are pressed against the transfer belt **50** with a large force, the transfer belt **50** warps and consequently the cleaning blades cannot be pressed against the transfer belt **50** at the appropriate angle. In consideration of this disadvantage, as shown in FIGS. **6** and **7**, the cleaning blade **53** is disposed in pressing contact with the transfer belt **50** at the circumferential surface of the drive roller **51** or the placing member **55** is disposed

in a position opposed to the cleaning blade **54** through the transfer belt **50**. In this way, it has been necessary to mount the cleaning blades **53**, **54** in pressing contact with the transfer belt **50** while adjusting suitably the relationship between the pressing forces of the cleaning blades **53**, **54** against the transfer belt **50** and the warping of the transfer belt **50** caused by these pressing forces.

However, if the cleaning blades **53**, **54** are mounted in pressing contact with the transfer belt **50** using the drive roller **51** or the placing member **55**, the transfer belt is held between the cleaning blades **53**, **54** and the drive roller **51** or the placing member **55** and thereby a torque of the transfer belt **50** increases. The increased torque of the transfer belt **50** causes undesirably the slipping between the transfer belt **50** and the drive roller **51**. This is extremely disadvantageous in terms of a sheet transporting performance, an image transferring timing, etc.

SUMMARY OF THE INVENTION

In view of the above described problem, it is an object of the invention to provide a cleaning device for a transfer belt of an image forming apparatus which has a simple construction and is capable of cleaning the transfer belt effectively over a long time without increasing a torque of the transfer belt.

Accordingly, the present invention is directed to a cleaning device for cleaning an endless transfer belt which is made of elastic material and stretched between a first roller and a second roller, one of the two rollers being adapted for driving the belt, the transfer belt being able to come into contact with a copy sheet on one stretch side thereof to convey the copy sheet in a direction from the first roller to the second roller, the cleaning device comprising: a cleaning blade member for removing toner from the belt, the cleaning blade member being disposed on the other stretch side of the transfer belt and near the second roller, being pressed against an outside surface of the belt, and having a leading end portion capable of coming into a line contact with the belt over an entire width of the belt when the belt being driven.

With thus constructed cleaning device, toner attached on the belt is removed by the cleaning blade member when the belt is rotated. In the rotation of the belt, the leading end portion of the cleaning blade member is liable to bend in the rotating direction due to the friction between the leading end and the belt. However, the arrangement of the cleaning blade member near the second roller can assure the line contact between the leading end of the cleaning blade member and the belt even if the leading end portion bends due to the rotation of the belt. Specifically, the belt pushes the cleaning blade member in an outward direction owing to the elasticity of the belt. On the other hand, the bent leading end portion of the cleaning blade member has a restoring force. These forces synergistically act to ensure the line contact over the entire width of the belt. The restoring force of the leading end portion enhances the toner removing performance of the cleaning blade member. Thus, a desirable cleaning performance can be obtained.

Further, the cleaning device may be further provided with an auxiliary roller either between the first roller and the second roller on the other stretch side and in contact with an inside surface of the belt or between the first roller and the second roller on the other stretch side and in contact with an inside surface of the belt, and

the cleaning blade member being disposed either between the second roller and the auxiliary roller and near the second roller or between the first roller and the auxiliary roller and near the auxiliary roller.

With this construction, the cleaning blade member is disposed either between the second roller and the auxiliary roller or between the first roller and the auxiliary roller. This reduces the indention portion of the belt which is caused by the pressing force of the cleaning blade member, and consequently reduces the expanding amount of the belt. Accordingly, the pressing force of the cleaning blade member against the belt can be maintained at a specified constant value suitable for cleaning.

It may be appropriate to further provide sensor means for measuring the temperature of the belt; moving means for moving the cleaning blade member in pressing and releasing directions; and controller means for calculating based on a measured temperature an appropriate moving amount of the cleaning blade member to keep the pressing force of the cleaning blade member against the belt at a constant value irrespective of the temperature of the belt, and controlling the moving means in accordance with the calculated moving amount.

Also, it may be appropriate to further provide sensor means for measuring the temperature of the belt; moving means for moving the auxiliary roller in pressing and releasing directions; and controller means for calculating based on a measured temperature an appropriate moving amount of the auxiliary roller to keep the pressing force of the cleaning blade member against the belt at a constant value irrespective of the temperature of the belt, and controlling the moving means in accordance with the calculated moving amount.

With these constructions, the moving amount of the cleaning blade member or auxiliary roller is adjusted in accordance with a change in the temperature of the belt. Accordingly, the pressing force of the cleaning member against the belt can be maintained at a constant value even when the belt is expanded or contracted depending on a change in the temperature of the belt.

Further, it may be preferable to render the cleaning blade member pressed in a direction perpendicular to an outside surface of the belt. This can obviate the cumbersome operation residing in the prior art which adjusts minutely the pressing force of the blade against the belt in relation to an angle at which the blade is in contact with the belt.

The above and other objects, features and advantages of the present invention will become more apparent upon a reading of the following detailed description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram showing a construction of cleaning device for a transfer belt according to the invention as a first embodiment;

FIG. **2** is a schematic diagram showing enlargedly a state where a cleaning blade is in contact with a transfer belt in the cleaning device;

FIG. **3** is a schematic diagram showing an overall construction of a copying machine incorporating the cleaning device according to the invention;

FIG. **4** is a schematic diagram showing a construction of a cleaning device for a transfer belt according to the invention as a second embodiment;

FIG. **5** is a schematic diagram showing a construction of a cleaning device for a transfer belt according to the invention as a third embodiment;

FIG. **6** is a schematic diagram showing a construction of a cleaning device for a transfer belt according to the invention as a fourth embodiment;

FIG. **7** is a schematic diagram showing a construction of a cleaning device for a transfer belt according to the invention as a fifth embodiment;

FIG. **8** is a schematic diagram showing a construction of an exemplary conventional counter type cleaning device for a transfer belt; and

FIG. **9** is a schematic diagram showing a construction of an exemplary conventional trail type cleaning device for a transfer belt.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

There will be first described a copying machine F (image forming apparatus) incorporating a cleaning device for a transfer belt according to the invention with reference to FIG. **3**.

The copying machine F includes a transparent document platen **1** and a document holder **2** in an upper portion thereof, and an optical assembly L, an imaging assembly P, a sheet transport assembly, and other elements in the interior thereof.

The optical assembly L includes a light source unit, reflecting mirrors **6**, **7**, **8** which forms an optical path by reflecting the reflected light from a document, a lens **10** for adjusting a magnification of an image to be formed, and a fixed mirror **9** for directing the reflected light to a photosensitive drum **11** to be described later. The light source unit has an exposure lamp **3** and a reflecting plate **4**, and moves reciprocally to scan a document image.

The imaging assembly P includes a photosensitive drum **11** on the surface of which an electrostatic image is formed, a charger **12** for charging the drum **11** to have a specified surface potential, a blank lamp **13** for removing electric charges in an unnecessary portion on the drum **11**, a developing device **14** for attaching toner to the electrostatic image on the drum **11** to develop the same into a toner image, a transfer device **15**, a cleaning device **16** for cleaning the toner remaining on the surface of the drum **11**. The transfer device **15** transfers the toner image to a copy sheet; separates the copy sheet from the drum **11**; and transports the copy sheet further to a downstream side. Indicated at **33** is a cleaning device for cleaning the toner attached to the transfer device **15**. The transfer and cleaning devices **15**, **33** will be described more in detail later.

The transport assembly includes cassettes **17**, **18** in which differently sized copy sheets can be contained, feed rollers **19**, **20** for dispensing copy sheets from the cassettes **17**, **18**, a pair of transport rollers **21**, a pair of registration rollers **22**, etc. in this order from an upstream side with respect to a sheet transport direction. The transport assembly also includes a fixing device **23**, a pair of discharge rollers **24**, etc. to transport the image bearing copy sheet to a further downstream side. The fixing device **23** fixes the toner image transferred to the copy sheet onto the copy sheet, and the discharge rollers **24** discharge the copy sheet onto a discharge tray **25**.

In the copying machine thus constructed, the light emitted from the exposure lamp **3** is reflected by the document surface and the reflected light representing

the document image is introduced to the photosensitive drum **11** through the reflecting mirror **6**, **7**, **8**, the lens **10**, and the fixed mirror **9**. The drum **11** is charged by the charger **12** to have the specified sur face potential while rotating in a direction of arrow. The charged surface of the drum **11** is exposed to the light from the optical assembly L, and thereby an electrostatic image is formed thereon. The electrostatic image formed on the drum **11** is transferred to the copy sheet fed from the cassette **17** or **18** by the transfer device **15** after being developed by the developing device **14**. The copy sheet bearing the toner image is separated from the drum **11** and transported by the transfer device **15**, and is discharged onto the discharge tray **25** through the fixing device **23** and the discharge rollers **24**.

There will be described a specific construction of the transfer and cleaning devices **15**, **33** as a first embodiment with reference to FIGS. **1** and **2**. In these figures, the transfer device **15** includes a transfer belt **39**, a charging roller **28**, and the cleaning device **33**. The transfer belt **39** separates the copy sheet from the drum **11** and transports the same further to the downstream side. To the charging roller **28** is applied a specified voltage, so that the toner image formed on the surface of the drum **11** is transferred to the copy sheet on the belt **39**. The cleaning device **33** removes the toner attached to the surface of the belt **39**.

The transfer belt **39** is an endless belt formed of urethane rubber or the like, and fluoro-coating is applied to the surface thereof. The belt **39** is stretched on a drive roller **26** disposed right upstream from the fixing device **23**, a driven roller **27** disposed right downstream from the registration rollers **22**, and intermediate rollers **29***a*, **29***b* which are grounded. The drive roller **29** is caused to rotate by an unillustrated motor, and thereby the belt **39** rotates in a direction of arrow in FIG. **1**.

The charging roller **28** is disposed in a position opposed to the photosensitive drum **11** while holding the transfer belt **39** therebetween. The outer circumferential surface of the roller **28** is in contact with the inner circumferential surface of the belt **39**. The roller **28** applies a high voltage supplied from an unillustrated transformer to the belt **39** at a specified timing. In this way, the toner image formed on the surface of the drum **11** is transferred to the copy sheet on the belt **39**. It is understood that the belt **39** is charged a little during the image transfer operation.

The cleaning device **33** is disposed below the transfer belt **39** between the drive and driven rollers **26**, **27**. The cleaning device **33** is located more toward the drive roller **26**. The cleaning device **33** includes a cleaning blade member (hereinafter referred to merely as a blade) for scratching off (removing) the toner attached to the surface of the belt **39**. The blade **34** is a plate-like member formed of urethane rubber or the like excellent in, for example, ozone resistance and durability. A leading end face of the blade **34** is in pressing contact with the surface of the belt **39** over the entire width of the belt **39** and a leading edge portion **40** is formed so as to define a desired angle, e.g., right angle, with high accuracy. The blade **34** is supported by a holder **35** and is mounted on a frame of the copying machine F through this holder **35**. Indicated at **33***a* is a casing for containing the collected toner.

The cleaning device **33** is disposed such that the leading end of the blade **34** is pressed against the transfer belt **39** vertically above, i.e., normal to the surface of the belt **39**. The pressing force of the blade **34** against the belt **39** causes the belt **39** to indent by a specified amount C (indent amount) from a position indicated by broken line. In this embodiment, it is accomplished to have a preferable cleaning performance over a long time by setting the indent amount C at 7 mm when a distance between the drive and driven rollers **26**, **27** is 200 mm.

There will be described an operation of thus constructed transfer device **15**.

When the registration rollers **22** are driven, thereby transporting the copy sheet to the transfer device **15**, the toner image formed on the sur face o f the photosensitive drum **11** is transferred to one face of the copy sheet due to a potential difference between the charging roller **28** and the drum **11**. The copy sheet bearing the toner image is transported further to the downstream side while being attached electrostatically to the transfer belt **39**; is separated from the belt **39** at the position of the drive roller **26** which is located most downstream in the transfer device **15**; and is transferred to the fixing device **23**. On the other hand, the toner attached to the belt **39** is removed by the blade **34** of the cleaning device **33** while the belt **39** is rotating, and is contained in the casing **33***a*. The electric charges carried by the belt **39** are removed through the intermediate rollers **29***a*, **29***b*.

There will be described an action of the cleaning device **33** with reference to FIG. **2**.

With the cleaning device **33** thus constructed, when the transfer belt **39** is rotated upon the start of the copying operation, the leading end of the blade **34** bends deformably to the downstream side with respect to the rotating direction of the belt **39** due to the frictional force acting between the belt **39** and the leading end of the blade **34**. Since the blade **34** is located near the drive roller **26** at this time, only the edge portion **40** of the blade **34** is in contact with the belt **39**. In this state, a force to press the edge portion **40** downward is acting on the belt **39** due to the elastic force thereof, whereas a force to restore the bent state of the blade **34** is acting on the edge portion **40**. More specifically, the edge portion **40** and the belt **39** are kept firmly in contact with each other by the action of these forces and particularly the force acting on the edge portion **40** acts as a force to scratch off the toner attached to the surface of the transfer belt **39** (edge effect). In this way, the blade **34** cleans the belt **39** satisfactorily.

When the blade **34** is located near the driven roller **27**, the blade **34** is in contact with the transfer belt **39** not at only the edge portion **40** as described above but at the entire leading end face. In this case, since the force of the blade **34** to restore from its bent state to its original state is dispersed over the entire leading end face of the blade **34**, the blade **34** and the belt **39** cannot be kept firmly in contact. As a result, the blade **34** cannot realize a desired cleaning performance.

There will be described a specific construction of the transfer **15** and cleaning devices **33** as a second embodiment next with reference to FIG. **4**. It will be appreciated that, in this figure, like reference numerals denote elements having like functions in FIGS. **1** and **2**.

The second embodiment differs from the first embodiment in that: 1) An auxiliary roller **30** is provided between the drive roller **26** and the driven roller **27**; 2) A belt temperature sensor is disposed in a position opposed to the driven roller **27**; and 3) The cleaning device **33** is further provided with an elevating mechanism for moving the blade **34** upward and downward and a CPU **32** for controlling the elevating mechanism.

The elevating mechanism includes an eccentric cam **37** and a motor **38** for rotating the eccentric cam **37**. The outer circumferential surface of the eccentric cam **37** mounted on a drive shaft of the motor **38** is slidably in contact with a horizontal support shaft **36** mounted projectingly on the holder **35** of the blade **34**. The motor **38** is caused to rotate in accordance with a control signal from the CPU **32**, thereby the blade **34** and the holder **35** move integrally vertically upward or downward. It is noted that an arrangement for supporting the holder **35** movably upward and downward is provided on the frame of the copying machine F. For example, this arrangement may include an oblong hole extending in the vertical direction through which the support shaft **36** is inserted and a guide member extending in the vertical direction.

The cleaning device **33** is disposed, as shown in FIG. **4**, such that the leading end of the blade **34** is pressed against the transfer belt **39** vertically above between the drive roller **26** and the auxiliary roller **30**, i.e., normal to the surface of the belt **39**. The pressing force of the blade **34** against the belt **39** causes the belt **39** to indent by a specified indent amount from a position indicated by broken line. For example, when a distance between the driven and driven rollers **26, 27** is 200 mm, the auxiliary roller **30** is disposed about 30 mm away from the drive roller **26** and the cleaning device **33** is disposed at least slightly toward the drive roller **26** from a middle point between the drive and auxiliary rollers **26, 30** (in FIG. **4**, A<B).

Incidentally, the urethane rubber of which the transfer belt **39** is formed has a specific degree of expansion in relation to a temperature (e.g., 5%/20° C.). The shorter the belt between rollers, the smaller the degree of expansion therebetween. Accordingly, as in this embodiment, a stretchable range of the belt **39** pressed by the blade **34** is narrowed by provided the auxiliary roller **30**, thereby enabling the degree of expansion of the belt **39** to be minimized. In view of this, the blade **34** is brought into pressing contact with the belt **39** between the drive and auxiliary rollers **26, 30** in order to maintain the actual pressing force of the blade **34** against the belt **39** in a desired range.

There will be described an operation of the cleaning device **33** in the second embodiment.

The CPU **32** reads a detected temperature data of the transfer belt **39** from the belt temperature sensor **31**. Based on this temperature data, the CPU **32** calculates the degree of expansion of the belt **39** or obtains the same from a conversion table. Based on this calculation result, the CPU **32** calculates an elevating amount of the blade **34**, i.e., how much the blade **34** is moved upward or downward. In fact, the CPU **32** obtains an amount by which the motor **38** should be driven. Subsequently, the CPU **32** outputs a control signal to the motor **38** so as to move the blade **34** upward or downward by the calculated elevating amount, and stores the elevating amount in a memory provided, for example, in the CPU **32**. In other words, the pressing force of the blade **34** against the belt **39** is maintained substantially at the same value by increasing or decreasing the indent amount of the belt **39** caused by the blade **34** according to the expansion of the belt **39**.

There will be next described an action of this cleaning device **33**. Since the blade **34** is located at a position where the distance A is at least shorter than the distance B, only the edge portion **40** of the blade **34** is in contact with the belt **39**. Accordingly, as described with reference to FIG. **2**, the force acting on the edge portion **40** acts as force to scratch off the toner attached to the surface of the transfer belt **39** (edge effect) and the blade **34** cleans the belt **39** satisfactorily. When A>B, the force of the blade **34** to restore from its bent state to its original state is dispersed over the entire leading end face of the blade **34** as described above, thus the blade **34** and the belt **39** cannot be kept firmly in contact. As a result, the blade **34** cannot realize a desired cleaning performance.

There will be described a specific construction of the transfer **15** and cleaning devices **33** as a third embodiment next with reference to FIG. **5**. It will be appreciated that, in this figure, like reference numerals denote elements having like functions in FIG. **4**.

The third embodiment differs from the second embodiment in that an elevating mechanism for moving the auxiliary roller **30** upward and downward in place of the elevating mechanism of the cleaning device **33**. Specifically, the outer circumferential surface of an eccentric cam **37** is slidably in contact with a rotatable shaft **41** of the auxiliary roller **30**. This eccentric cam **37** is rotated by the motor **38** to thereby move the auxiliary roller **30** upward and downward, i.e. to move the auxiliary roller toward and away from the transfer belt **39**. In this way, the pressing force of the blade **34** against the belt **39** is maintained stably. It is understood that the rotatable shaft **41** is supported rotatably in an oblong hole formed in the frame of the copying machine F. The CPU **32** calculates the elevating amount of the auxiliary roller **30** based on the detected temperature data from the belt temperature sensor **31** and controls the rotation of the motor **38** based on the calculated ed elevating amount.

Although the auxiliary roller **30** and the elevating mechanism are employed in the second and third embodiments, the invention is not limited to such a construction. The invention can be embodied in the transfer device **15** including only the auxiliary roller **30** without the elevating mechanism.

As described above, in a cleaning device for a transfer belt according to the invention, a blade **34** is brought into pressing contact with a transfer belt **39** in a direction normal to the surface of the belt **39** and only a downstream edge portion **40** of a leading end of the blade **34** is kept in pressing contact with the surface of the belt **39**, making use of the deformable bending of the blade **34** due to the rotation of the belt **39**. Accordingly, a desirable cleaning performance can be obtained over a long time only by bringing the blade **34** to contact with the belt **39** from a direction normal to the surface of the belt **39**. This obviates the need for a cumbersome operation for adjusting minutely the pressing force of the blade against the transfer belt in relation to an angle at which the blade is in contact with the transfer belt as in a case of the prior art where the driven roller and the placing member are utilized. Further, since the transfer belt is not held between the blade and the driven roller or is not slidable in contact with the placing member, there will be no undesirable increase in the torque of the transfer belt **33**. Thus, this cleaning device **33** is free from the slipping between the transfer belt **39** and the drive roller **26**.

It may be also appropriate to dispose the cleaning device **33** in a position closer to the auxiliary roller **30** between the driven roller **27** and the auxiliary roller **30** in such a manner that the blade **34** is in pressing contact with the transfer belt **39** FIGS. **6** and **7**. More specifi-

cally, FIG. 6 shows a fourth embodiment which has the same construction as the second embodiment except for the cleaning device 33 being disposed between the auxiliary roller 30 and the driven roller 27. FIG. 7 shows a fifth embodiment which has the same construction except for the cleaning device 33 being disposed between the auxiliary roller 30 and the driven roller 27. This arrangement also ensures effects similar to the ones obtained in the second and third embodiments. The elevating mechanism is not limited to the eccentric cam, but may be a crank mechanism or sliding mechanism. Further, the material for the blade 34 is not limited to an elastic material such as urethane rubber, but may be a material having a certain rigidity.

Although the present invention has been fully described by way of example with reference to the accompanying drawings, it is to be understood that various changes and modifications will be apparent to those skilled in the art. Therefore, unless otherwise such change and modifications depart from the scope of the invention, they should be construed as being included therein.

What is claimed is:

1. A cleaning device for cleaning an endless transfer belt which is made of elastic material and stretched between a first roller and a second roller, one of the two rollers being adapted for driving the belt, the transfer belt being able to come into contact with a copy sheet on one stretch side thereof to convey the copy sheet in a direction from the first roller to the second roller, the cleaning device comprising:

a cleaning blade member for removing toner from the belt, the cleaning blade member;

being disposed on the other stretch side of the transfer belt and near the second roller;

being pressed against an outside surface of the belt; and

having a leading end portion capable of coming into a line contact with the belt over an entire width of the belt when the belt is driven;

sensor means for measuring the temperature of the belt;

moving means for moving the cleaning blade member in pressing and releasing directions; and

controller means for calculating based on a measured temperature an appropriate moving amount of the cleaning blade member to keep the pressing force of the cleaning blade member against the belt at a constant value irrespective of the temperature of the belt, and controlling the moving means in accordance with the calculated moving amount.

2. A cleaning device for cleaning an endless transfer belt which is made of elastic material and stretched between a first roller and a second roller, one of the two rollers being adapted for driving the belt, the transfer belt being able to come into contact with a copy sheet on one stretch side thereof to convey the copy sheet in a direction from the first roller to the second roller, the cleaning device comprising:

a cleaning blade member for removing toner from the belt, the cleaning blade member;

being disposed on the other stretch side of the transfer belt and near the second roller;

being pressed against an outside surface of the belt; and

having a leading end portion capable of coming into a line contact with the belt over an entire width of the belt when the belt is driven;

an auxiliary roller provided between the first roller and the second roller on the other stretch side and in contact with an inside surface of the belt, wherein the cleaning blade member is disposed between the second roller and the auxiliary roller and near the second roller;

sensor means for measuring the temperature of the belt;

moving means for moving the auxiliary roller in pressing and releasing directions; and

controller means for calculating based on a measured temperature an appropriate moving amount of the auxiliary roller to keep the pressing force of the cleaning blade member against the belt at a constant value irrespective of the temperature of the belt, and controlling the moving means in accordance with the calculated moving amount.

3. A cleaning device for cleaning an endless transfer belt which is made of elastic material and stretched between a first roller and a second roller, one of the two rollers being adapted for driving the belt, the transfer belt being able to come into contact with a copy sheet on one stretch side thereof to convey the copy sheet in a direction from the first roller to the second roller, the cleaning device comprising:

a cleaning blade member for removing toner from the belt, the cleaning blade member;

being disposed on the other stretch side of the transfer belt and near the second roller;

being pressed against an outside surface of the belt; and

having a leading end portion capable of coming into a line contact with the belt over an entire width of the belt when the belt is driven;

an auxiliary roller provided between the first roller and the second roller on the other stretch side and in contact with an inside surface of the belt, wherein the cleaning blade member is disposed between the first roller and the auxiliary roller and near the auxiliary roller;

sensor means for measuring the temperature of the belt;

moving means for moving the auxiliary roller in pressing and releasing directions; and

controller means for calculating based on a measured temperature an appropriate moving amount of the auxiliary roller to keep the pressing force of the cleaning blade member against the belt at a constant value irrespective of the temperature of the belt, and controlling the moving means in accordance with the calculated moving amount.

4. A cleaning device comprising an endless transfer belt having material thereon to be cleaned, first and second rollers spaced from one another, each of said first and second rollers having a center of rotation, each of said first and second rollers having an outer periphery, said endless transfer belt having a belt section which passes from the outer periphery of said first roller to the outer periphery of said second roller, said outer periphery of said first and second rollers defining a straight line path which extends tangentially from the outer periphery of said first roller and tangentially from the outer periphery of said second roller and which is parallel to a line connecting the centers of rotation of said first and second rollers, a cleaning blade means for removing said material from said belt, said cleaning blade means being disposed along said belt section spaced from said first and second rollers, and support-

ing means supporting said cleaning blade means against said belt section such that said belt section is deviated from said straight line path, said cleaning blade means comprising an elongated cleaning blade member having a longitudinal axis, said longitudinal axis being disposed perpendicular to said straight line path, said cleaning blade means being made of a resilient material, said cleaning blade means comprising an elongated cleaning blade member having an elongate axis, said cleaning blade member having a main portion and a terminating end portion, said elongate axis having a main elongate axis portion extending along said main portion of said cleaning blade member, said elongate axis having a terminating end elongate axis portion extending along said terminating end portion of said cleaning blade member, said terminating end portion of said cleaning blade member having an unflexed state in which said main elongate axis portion is substantially linearly aligned with said terminating end elongate axis portion, said terminating end portion of said cleaning blade member having a flexed state in which said terminating end elongate axis portion is disposed at an obtuse angle relative to said main elongate axis portion, said supporting means being operable to force said terminating end portion of said cleaning blade member against said belt section to thereby force said terminating end portion of said cleaning blade member into said flexed state, said section traveling from said first roller to said second roller, said cleaning blade member having a leading face and a trailing face, said leading face facing said first roller, said trailing face facing said second roller, said leading face having a main leading face section on said main portion of said cleaning blade member, said trailing face having a main trailing face section on said main portion of said cleaning blade member, said cleaning blade member having a terminating end leading face section on said terminating end portion of said cleaning blade member, said trailing face having a terminating end trailing face section on said terminating end portion of said cleaning blade member, said terminating end leading face section being disposed at an obtuse angle relative to said main leading face section when said terminating end portion is in said flexed state, said terminating end portion having a terminating end surface, said terminating end leading face section intersecting said terminating end surface along a leading edge, said leading edge engaging said belt section when said cleaning blade member is in said flexed state, said terminating end surface forming an acute angle with the part of the belt section which extends from said leading edge to said second roller when said cleaning blade means is in said flexed state.

5. A cleaning device secondary to claim **4** wherein said straight line path defined by said first and second rollers has a first end disposed on the periphery of said first roller and a second end disposed on the periphery of said second roller, said cleaning blade means contacting said belt section at a contact position, said belt section having a first belt part which extends from said first end of said straight line path to said contact position, said belt section having a second belt part which extends from said contact position to said second end of said straight line path, said first belt part being disposes at an obtuse angle relative to said second belt part.

6. A cleaning device according to claim **5** wherein said belt section travels from said first roller to said second roller during cleaning, said first belt part being delineated an upstream belt part said second belt part being delineated a downstream belt part, said downstream belt part being longer than said upstream belt part.

7. A cleaning device according to claim **4** wherein said terminating end trailing face section is disposed at an obtuse angle relative to said main trailing face section when said terminating end portion is in said flexed state.

8. A cleaning device according to claim **4** wherein said terminating end leading face section forms an acute angle with the part of the belt section which extends from said first roller to said leading edge when said cleaning blade member is said flexed state.

9. A cleaning device comprising an endless transfer belt having material thereon to be cleaned, first and second rollers spaced from one another, each of said first and second rollers having a center of rotation, each of said first and second rollers having an outer periphery, said endless transfer belt having a belt section which passes from the outer periphery of said first roller to the outer periphery of said second roller, said outer periphery of said first and second rollers defining a straight line path which extends tangentially from the outer periphery of said first roller and tangentially from the outer periphery of said second roller and which is parallel to a line connecting the centers of rotation of said first and second rollers, a cleaning blade means for removing said material from said belt, said cleaning blade means being disposed along said belt section spaced from said first and second rollers, and supporting means supporting said cleaning blade means against said belt section such that said belt section is deviated from said straight line path, said cleaning blade means comprising an elongated cleaning blade member having a longitudinal axis, said longitudinal axis being disposed perpendicular to said straight line path, said cleaning blade means being made of a resilient material, said cleaning blade means comprising an elongated cleaning blade member having an elongate axis, said cleaning blade member having a main portion and a terminating end portion, said elongate axis having a main elongate axis portion extending along said main portion of said cleaning blade member, said elongate axis having a terminating end elongate axis portion extending along said terminating end portion of said cleaning blade member, said terminating end portion of said cleaning blade member having an unflexed state in which said main elongate axis portion is substantially linearly aligned with said terminating end elongate axis portion, said terminating end portion of said cleaning blade member having a flexed state in which said terminating end elongate axis portion is disposed at an obtuse angle relative to said main elongate axis portion, said supporting means being operable to force said terminating end portion of said cleaning blade member against said belt section to thereby force said terminating end portion of said cleaning blade member into said flexed state, said section traveling from said first roller to said second roller, said cleaning blade member having a leading face and a trailing face, said leading face facing said first roller, said trailing face facing said second roller, said leading face having a main leading face section on said main portion of said cleaning blade member, said trailing face having a main trailing face section on said main portion of said cleaning blade member, said cleaning blade member having a terminating end leading face section on said terminating end portion of said cleaning blade member, said trailing face having a terminating end trailing face section on said terminating end portion

of said cleaning blade member, said terminating end leading face section being disposed at an obtuse angle relative to said main leading face section when said terminating end portion is in said flexed state, said terminating end portion having a terminating end surface, said terminating end leading face section intersecting said terminating end surface along a leading edge, said leading edge engaging said belt section when said cleaning blade member is in said flexed state, said terminating end surface being spaced from said belt section when said cleaning blade means is in said flexed state.

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